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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,082	06/22/2001	Kenneth J. Hines	10488/14:1 USA	6550

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EXAMINER

KANG, INSUN

ART UNIT PAPER NUMBER

2124

DATE MAILED: 09/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/888,082

Applicant(s)

HINES, KENNETH J.

Examiner

Insun Kang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1/27/03, 3/12/02, 10/19/01, 10/10/01, 6/22/01
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-24 is/are pending in the application.
- 4a) Of the above claim(s) 1-20 and 25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10/19/2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/27/03; 10/10/01, 3/12/02</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This action is responding to application papers dated 1/27/2003, 3/12/2002, 10/19/2001, 10/10/2001, and 6/22/2001.
2. Claims 21-24 are pending in the application.

Election/Restrictions

3. Applicant's election without traverse of claims 21-24 in response to the examiner's restriction request via a telephone on 9/1/2004 is acknowledged (Attorney: Michael R. Barre). Claims 1-20 and 25 have been cancelled as part of Restriction practice. Claims 21-24 are pending in the application.

Drawings

4. The drawings are objected to because: there appears to be a typographical error in page 13-14 ("Fig.44A is an edge...true at its head" appears to be corrected to "...false at its head," same for Fig.44B; For Fig.44C and 44D, "false" to "true"). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the

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brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

5. Applicant is reminded of the proper content of an abstract of the disclosure.

A patent abstract is a concise statement of the technical disclosure of the patent and should include that which is new in the art to which the invention pertains. If the patent is of a basic nature, the entire technical disclosure may be new in the art, and the abstract should be directed to the entire disclosure. If the patent is in the nature of an improvement in an old apparatus, process, product, or composition, the abstract should include the technical disclosure of the improvement. In certain patents, particularly those for compounds and compositions, wherein the process for making and/or the use thereof are not obvious, the abstract should set forth a process for making and/or use thereof. If the new technical disclosure involves modifications or alternatives, the abstract should mention by way of example the preferred modification or alternative.

The abstract should not refer to purported merits or speculative applications of the invention and should not compare the invention with the prior art.

Where applicable, the abstract should include the following:

- (1) if a machine or apparatus, its organization and operation;
- (2) if an article, its method of making;
- (3) if a chemical compound, its identity and use;
- (4) if a mixture, its ingredients;
- (5) if a process, the steps.

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Extensive mechanical and design details of apparatus should not be given.

The abstract simply recites the general use and benefit of static analysis. It does not contain the concise statement of the technical disclosure of the present invention.

Appropriate correction is required.

6. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

The abstract contains phrases such as "Disclosed are" which can be implied. Appropriate correction is required.

Claim Rejections - 35 USC § 101

7. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8. Claims 21-24 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 21-24 are non-statutory because they are directed to a "method" without recitation of a computer or a computer-readable medium embodying the

method for converting a control graph representation of a software system. The claims merely recite a "a method" that is disembodied arrangement so as to be called a "computer program" or compilation of facts, information, or data *per se*, without creating any functional interrelationship, either as part of the stored data or as part of the computing processes performed by the computer ("acts") or computer readable medium so as to enable the computer to perform the claimed steps of converting a control graph representation, transforming the graph, generating a binary decision diagram, etc as recited. Thus the claims represent non-functional descriptive material that is not capable of producing a useful result, and hence represent only abstract ideas. Therefore, the claims are non-statutory.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claims 21 and 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Reps (US Pub. 2002/0078431).

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Per claim 21:

Reps discloses:

- converting a control graph representation of a software system, having a state space and an initial state, into a binary decision diagram of the software system ("An OBDD is based on the representation of a Boolean function as an ordered binary decision tree...An OBDD is a folded version of the binary decision tree in which substructures are shared as much as possible, which turns the tree into a directed acyclic graph (DAG)," page 1 paragraphs 0013-0014; "when unfolding a decision tree into a CFOBDD, and when unfolding a CFLOBDD to create the corresponding decision tree," page 3 paragraph 0056).
- transforming the control graph to express a potential next state of the software system after a predetermined period of time ("when unfolding a decision tree into a CFOBDD, and when unfolding a CFLOBDD to create the corresponding decision tree," page 3 paragraph 0056)
- generating a binary decision diagram based on the transformed control graph, whereby known static error checking techniques may be used to further identify any unexpected behavior of the software system without incurring the cost of fully elaborating the state space of the software system ("An OBDD is based on the representation of a Boolean function as an ordered binary decision tree...An OBDD is a folded version of the binary decision tree in which substructures are shared as much as possible, which turns the tree into a directed acyclic graph (DAG)," page 1

paragraphs 0013-0014; "when unfolding a decision tree into a CFOBDD, and when unfolding a CFLOBDD to create the corresponding decision tree," page 3 paragraph 0056; BDDs have been ... applied ... analysis, synthesis, optimization, timing analysis... and verification of software systems," page 3 paragraph 0040) as claimed.

Per claim 22:

The rejection of claim 21 is incorporated, and further, Reps teaches:

- transforming the control graph comprises unrolling the control graph ("when unfolding a decision tree into a CFOBDD, and when unfolding a CFLOBDD to create the corresponding decision tree," page 3 paragraph 0056) as claimed.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reps (US Pub. 2002/0078431) as applied to claims 21 and 22 above, and further in view of Bryant ("Symbolic Boolean Manipulation with Ordered Binary-Decision Diagrams," ACM, 9/1992).

Per claim 23:

The rejection of claim 22 is incorporated, further, Reps does not explicitly teach the apply algorithm. However, Bryant teaches the apply operation was known in the art of software development and debugging, at the time applicant's invention was made, to generate "Boolean functions by applying algebraic operations to other functions (page 301, 3.1 The APPLY Operation). It would have been obvious for one having ordinary skill in the art of computer software development and debugging to modify Reps' disclosed system to use the apply operation to construct the BDD representation. The modification would be obvious because one having ordinary skill in the art would be motivated to "improve the efficiency of the computation and to assist in producing a maximally reduced graph" as the "APPLY algorithm operates by traversing the argument graphs depth first while maintaining two hash tables" as suggested by Bryant (page 301, 3.1 The APPLY Operation).

Per claim 24:

The rejection of claim 23 is incorporated, further, Reps discloses:

- unrolling the control graph comprises: creating a copy of each disjunctive node, each disjunctive node represents a boolean guard on a functional object within one of the software elements ("each element of an Unfold trace is structurally equal to the corresponding object in the Fold trace," page 11 paragraph 0219-0224) ; creating a copy of each conjunctive node, each conjunctive node

represents a conjunctive boolean guard on state changes within the software system("each element of an Unfold trace is structurally equal to the corresponding object in the Fold trace," page 11 paragraph 0219-0224) ; creating a copy of each action node, each action node represents a functional object within one of the software elements that is responsive to a control interaction and capable of producing a control interaction, if the functional object it represents performs a predetermined function without a predetermined delay ("each element of an Unfold trace is structurally equal to the corresponding object in the Fold trace," page 11 paragraph 0219-0224) for each delayed action node which represents a functional object within one of the software elements that has a predetermined delay in responding to or producing, a control interaction, creating a sensing edge to connect the delayed action node to a corresponding node in the control graph representing the initial state of the system and creating an outgoing edge to connect the corresponding node, in the control graph representing the initial state of the system, to a corresponding next node, which represent the potential next state of the system; (page 15 paragraphs 0319-323) for outgoing edge, that is also an event edge, connecting the outgoing edge to a create event disjunctive node, which represents an event generated by the corresponding node in the control graph representing the initial state of the system (page 16 paragraphs 0327-0329); for each created event disjunctive node, creating an edge from the created event disjunctive node to an event conjunctive node; for each event conjunctive node, creating an edge from the node that generated the event to the event conjunctive node, and creating an

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edge from the event conjunctive node to the copy of the node that generated the event (page 18 paragraphs 03"each element of an Unfold trace is structurally equal to the corresponding object in the Fold trace," page 11 paragraph 0219-0224) as claimed.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Insun Kang whose telephone number is 703-305-6465. The examiner can normally be reached on M-F 8:30-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on 703-305-9662. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

IK
9/2/2003


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